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by

Barry Lenk
Henry Solomon

Serial T-370
23 March 1979

The George Washington University
School of Engineering and Applied Science
Institute for Management Science and Engineering

Program in Logistics

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1. Introduction

The role and treatment of profit and its relationship to capital investment in the context of defense procurement present complex technical and policy issues. This paper is devoted to only a few of these issues. It has been motivated in part by changes in the Department of Defense (DOD) guidelines in considering facilities investment when negotiating profit objectives for cost-type contracts.

On September 1, 1976, Defense Procurement Circular (DPC) 76-3 was issued and instructed DOD contracting officers to place greater emphasis on the level of facilities investment when negotiating a profit objective for a cost-type contract. This was accomplished by changing the relative weights of importance assigned to the determinants of profit.

Prior to DPC 76-3, prenegotiation profit determinants and their relative weights were as follows:

Contractors Input to Total Performance	65%
Contractors Assumption of Contract Cost Risk	30%
Other Factors	5%

The factors have been revised as follows:

Contract Effort	50%
Cost Risk	40%
Investment	10%

The relative weight of 10 percent assigned to investment is to be re-evaluated by DOD in the future so as to determine if a further increase in this factor is to be justified. The major reason for the revision is a policy designed to reward those contractors who increase their risk by investing in facilities and thereby enhance the possibility of greater productivity.

While it should be useful to comment on the particular changes resulting from DPC 76-3, its appearance also provides an opportunity to review other considerations for assessing profitability.

2. General Remarks on Measurements and Assessment of Profitability in Defense Contracting

The recent recognition of facilities investment as a determinant for profits may be surprising, not because it has been accomplished, but rather because it was not done much earlier. There is nothing new in considering profits as a function of investment and its associated risks and probable consequences for increasing efficiency of production. What is new is the inclusion of investment as an argument for determination of profit in defense contracting, and in particular, for negotiating profit objectives with cost-type contracts.

Before going on, it should be useful to differentiate two general types of contracts, i.e., fixed price and cost-type contracts. There are variants of these two general types of contracts but this simple dichotomy is nevertheless appropriate and useful for our purposes.

In a situation permitting competitive bids resulting in fixed price contracts, the operation of the market serves to govern the level of costs and profits. Fixed price contracts are generally for the procurement of fairly standard items or services which are not complex and are specified adequately in technical terms. There is little or no uncertainty about the product or the means for producing the product. The products are equivalent or similar to other items which have been produced before, usually by many sellers. If not, the sellers have the necessary production capability and know-how.

Cost-type contracts are utilized for the procurement of large complex items such as large weapon systems which typically require research and development. The condition which best characterizes the procurement of these items is uncertainty, i.e., uncertainty about the product and the means for producing the product. The rationale for utilizing cost-type contracts in these cases is explained very well by Arrow [3, p.614] as follows:

"Cost-plus contracts are necessitated by the inability or unwillingness of firms to bear the risks. The government has superior risk bearing ability and so the burden is shifted to it. It is then enabled to buy from firms on the basis of their productive efficiency rather than their risk bearing ability, which may be only imperfectly correlated."

With cost-type contracts, there are generally few possible sellers, there are uncertainties about the products and the means for producing and delivering the products with the desired delivery schedules. With rare

exceptions, a competitive market does not exist to govern the levels of costs and profits. The government has yet to develop an appropriate and generally accepted conceptual basis for the determination of profits in cost reimbursement contracts. Without such a rationale, the government's view of profit in fixed price contracts, i.e., profit as an acceptable percentage of costs, is recognized in the negotiation of profits for cost-type contracts, (see [5]). Hence the mild attention given to facilities investment in the new DOD guidelines represents an important change from the past.

The determination of profit as a percentage of costs in cost-type as distinct from fixed price contracts presents conceptual and practical difficulties. In a competitive situation with fixed price contracts, the use of measuring profit as a percentage of costs has some practical value for assessment. In these cases there exists an industry or large collection of firms producing or capable of producing the desired product or similar products. Hence profit as a percentage of costs for one firm can be compared with other firms. Also typically, the product or similar products have been produced in the past and therefore it is feasible to examine the ratios of profits to costs over time and judge whether profits are excessive or normal at any point in time.

In the case of cost-type contracts for a new weapon system, the practical advantages just noted are absent. It is likely that the chosen contractor is the sole supplier of the product and the product has not been produced before. Hence comparative analysis either of a cross-sectional variety or longitudinal type cannot be effected in a satisfactory manner.

While competitive bidding tends to control the amount of cost and profit in fixed price contracts, cost reimbursement contracts are not subject to the same limitation. The weighted guidelines - contractor effort, cost of risk, and investment -- should not be viewed as the major determinants

of profits in cost contracts. These are only secondary factors which may permit limited adjustments of the primary profit figure which is determined on the basis of contract cost. The effect of profit determination based on cost is to limit the impact of the facilities investment weighted guidelines upon productivity. The increased importance in profit determination given to capital outlays in the weighted guidelines is designed to achieve reduced contract cost by increasing efficiency. However, it is total cost which is the primary basis for determining profits. As a result, the contractor remains likely to forego capital investment.

A major and difficult issue arises from the difference between determining profits based on costs and profit determination as a return on capital. While costs may in fact be the determinant for profits, the notion of rate of return on capital must provide the means for assessing whether or not profits in defense industries are adequate. The task is not only that of simply calculating profits related to assets from accounting documents, but also to evaluate relative risk and efficiency. More specifically, return on capital in a particular defense industry must be related to the return in other industries with cognizance given to the relative risks and efficiencies in the defense and non-defense industries.

There have been a number of studies directed at assessing the relative profitability of defense to non-defense industries. Unfortunately these studies have shed more heat than light. The results have varied from conclusions that defense industries have been more profitable, less profitable, and equally profitable when compared to non-defense industries. For example, Weidenbaum [9] concluded that defense profits are excessive; the Logistics Management Institute [8] concluded that defense profits are too low; the General Accounting Office [4] concluded that there was little difference in profitability between defense and non-defense industries; and Stigler and Friedland [7] concluded that relative profitability varied by

decade. There were methodological reasons for the marked variations in conclusions, e.g., different data bases, different procedures for attribution of revenues and assets for defense vs. non-defense activities, etc. What is important are the barriers to conclusive empirical work in this area. Some of these barriers include the difficulties in and therefore absence of an ex post analysis of risk and efficiency, the technical difficulties of isolating use of assets and sources of income within defense firms, the peculiarity of the presence of government furnished plant and equipment in contractor plants and used for defense products. Given these and other difficulties, further empirical studies similar to those in the past may not be expected to be very enlightening.

Our major concern here is not empirical studies of profitability of past procurements but rather to address how profit should be determined in the future. Some particular considerations in this regard will be addressed in the following sections.

3. Profit and Investment

The new DOD guidelines recognize investment as a determinant of profit, albeit in a small way. Again the major motivation is to provide an incentive for contractors to increase investments and thereby increase productivity. In contrast, a result of determining profits solely as a percentage of cost for cost-type contracts does not provide an incentive to achieve the optimum combination of capital and labor. Instead current policies tend to encourage defense contractors to emphasize labor intensive means of production.

In addition to relating profit to investment for efficiency, another important parameter for profit is risk of investment. Among other conditions, the evaluation of risk associated with an investment depends on the timing of the investment in relation to the actual award of the contract. Obviously, the degree of risk depends on whether the investment takes place prior to negotions for the award, during negotiations, or following

the award. Also, of course, the length of the production period will affect the degree of risk. The DOD guidelines are silent on this element of timing of the investment. However, it becomes crucial in assessing profitability relative to investment. For example, take the case of a firm considering entry into a defense industry. Assuming significant investment necessary to enter the industry and be considered for a procurement award, profitability must account for risk prior to negotiations or new entrants will not be forthcoming.

4. Risk in Commercial vs. Government Markets

The concept of risk is critical for an understanding of profitability. In production for commercial markets, the firm estimates the market potential for a particular product and invests an appropriate level of risk capital in the factors of production necessary to manufacture the item. Other things being equal, if the contractor sells less than the projected demand for his product, his profit is less than expected; if he sells more, his profit is greater than expected. This uncertainty of sales and profits is central to the concept of risk - the greater the investment in the factors of production, the more substantial is the risk involved and the necessary level of potential profit to induce this risk. For this reason, the measure of profitability of a company can be calculated as a ratio of net income to capital investment, since the other factors of production are usually factored out of gross income as costs.

The presence of risk in the defense market depends on the time period and the product. In an era of mobilization or war, the volume of the defense industries' sales will no doubt increase and then decline following the end of hostilities. From the point of view of an individual firm this suggests instability in the defense market and the element of risk appears to be high. A vendor for ammunitions is likely to experience an abrupt curtailment of orders once hostilities have ended. This is less likely to be true for the

supplier of major weapon systems. When a firm's business is subject to a sudden termination of a contract, appropriate termination clauses may be included in the contract which would minimize hardship to the firm.

For the most part, the business of supplying major weapon systems has been less risky than has been the case for many industries in the commercial sector. For weapon system production, the financial risk associated with uncertainty of the product is borne by the government with the use of cost-type contracts. While it is at least implicitly assumed that the contractor has the appropriate technical expertise, much of the financial risk associated with uncertainties about the product and production of the product are borne by the government with the cost-type contracts. It is likely that in the future the suppliers of major weapon systems will be exposed to even less risk than in the past. This is based on the supposition that there will be fewer weapon systems produced but with longer production lead times and in greater quantities for individual firms. Hence the contractors receiving the procurement awards will have sales stability over long time periods. The new weapon systems will be complex involving considerable research and development costs providing the government incentive for fewer kinds of systems and a larger number of units of each system.

The minimization of risk to the contractor may be a major ingredient of the government procurement problem, i.e., high costs. The answer may be to encourage the contractors to assume greater risks via investment in new technology while ensuring an equitable rate of return.

In cost-type contracts, the government minimizes the contractual risk of an uncertain market by establishing its requirements, usually for the fiscal year, with prices based upon costs during that particular period. Not only is the contractor thereby virtually guaranteed a profitable market, but his working capital requirements are reduced because of higher government payments in early years when production costs are high. Because of the reduced level of risk and the lower investment requirements for government

business, a lower rate of profit is appropriate for government cost-type contracts in comparison with commercial production.

However, by routine utilization of the level of facilities investment as a determinant of profit, the opposite effect may be achieved: capital investment per se may be rewarded regardless of the degree to which it embodies the element of risk. Armed Services Procurement Regulation (ASPR) 3-808.7, the new facilities capital investment section, could lead to an erroneous assessment. The rationale for this policy is to "...result in profit opportunities competitive with those attainable in a free enterprise market for similar investments of resources and assumptions of risk." [1] The problem with this is that in practice it may assume capital investment to be uniformly risk-laden regardless of the market structure within which it operates. This standard ignores the reduced risk in government cost reimbursement contracts, which provide for the establishment of product quantities required for the fiscal year at prices based upon the contractor's cost.

In addition to creating a questionable basis for profitability, the erroneous assumptions underlying this policy may result in the pyramiding of payments to the contractor in two separate instances. First, because cost risk comprises a 40 per cent weighted factor in the determination of profits categories. This result is especially probable in view of ASPR's tendency to equate capital investment with cost risk without regard to the market structure within which the investment takes place. Second, government purchases of a product in earlier years recognize certain non-recurring costs. Furthermore, ASPR XV, "Contract Cost Principles and Procedures," [2] delineates those contractor costs which are subject to reimbursement by the government under negotiated procurement. Where these allowable costs coincide with the basis for determining profitability under the facilities capital investment factor, a double payment to the contractor may result.

Two examples illustrate this problem: ASPR 15-205.12 "Cost of Idle Facilities and Idle Capacity" and ASPR 15-205.30 "Precontract Costs." Under ASPR 15-205.12 the costs of idle facilities are allowable

where "(i) they are necessary to meet fluctuations in workload, they were necessary when acquired and are now idle because of changes in program requirements, contractor efforts to produce more economically, reorganization, termination, or other causes which could not have been reasonably foreseen."[2,P.904] The cost of idle capacity is allowable if the capacity is or was "reasonably anticipated to be necessary" and is not subject to elimination or reduction. Hence, the contractor may not only receive increased profits from over-investment, but costs for the idle plant and equipment may under certain circumstances be reimbursed by the government.

ASPR 15-205.30 provides for the reimbursement of costs "incurred prior to the effective date of the contract directly pursuant to the negotiation and in anticipation of the award of the contract where such incurrence is necessary to comply with the proposed delivery schedule." [2,P.905] Although these costs are allowable only to the extent that they would have been after the contract was awarded, it is possible that a contractor may engage in an extensive program of capital investment to ensure that he is awarded a contract, after which he may be reimbursed for costs incurred under 15-205.30, and he may also use this investment as a partial determinant of profits under the weighted guidelines.

The problem of cost accounting for outlays of fixed capital presents a fundamental problem in determining a rate of profit based in part upon capital investment. The accounting method currently employed in cost reimbursement contracts is full-absorption costing, whereby fixed costs are calculated as a part of each product manufactured during the accounting period. This approach essentially treats fixed costs in the same manner as variable costs.

Full-absorption accounting of fixed costs is implemented through the practice of depreciation, or the allocation of the diminishment of the service potential or a tangible capital asset during a given period and/or between certain products. While useful for net income measurement or the

determination of income tax liability, depreciation rarely reflects the decline in or current level of actual service potential for tangible capital assets. Depreciation serves as a method by which paper calculations, rather than realistic assessments, are made. The next section of this paper suggests an alternative method of cost accounting.

5. Working Capital, Fixed Capital and Opportunity Cost

An alternative to full-absorption costing is direct cost accounting, which assigns direct costs, i.e., working capital outlays, as a product charge to particular contracts while fixed expenses are calculated as period charges. The problem which therefore remains is to determine the profitability of fixed capital outlays in cost reimbursement contracts.

One approach for determining profitability of fixed expenses is through a capitalization formula, which is based upon expectations of future earning power of a contemplated investment in a durable capital asset. A useful basis for this form of valuation is the concept of opportunity cost, or the cost to the user of foregoing alternative utilization of plant and equipment. "User cost" is traditionally calculated in terms of opportunities in alternative markets. This analysis is largely inapplicable to most major defense-oriented facilities because they are so heavily specialized that the enormous costs of conversion would prevent the development of a meaningful alternative market opportunity cost.

A more appropriate means to measure the rate of return for fixed capital in defense industries is the alternative internal use to which the plant may employ the capital. This approach regards each contract as a separate market, and profit negotiations are based upon the degree to which the plant would otherwise approach full capacity utilization during the contracting period if the contract award was not made. A plant operating far below capacity would find a distinctly lower opportunity cost than another operating near capacity; the rate of return for fixed capital investment by each company

should be investigated accordingly. Failure to make this distinction results in an equivalent rate of return for excess capacity as for facilities which would otherwise be utilized.

6. Conclusion

The change in the weighting of profit guidelines should not be expected to provide an adequate incentive to increase productivity through greater capital investment. There is need to develop a more appropriate conceptual basis for the establishment of profits. As long as profits are established principally as a function of total costs with the use of cost type contracts, the incentives for increased productivity via investment will be at a minimum. Considering investment as described in the current guidelines for cost-type contracts may, in fact, be perverse.

What appears to be required is a major shift from cost-type contracts as we now know them. One of the most attractive paths to follow is to replicate as much as possible those practices which are found in the commercial markets. That is, to achieve a rate of return to the contractors consistent with the level of risk and efficiency for each contract. To accomplish this requires an extra pricing of the procurement on the basis of the contractor's capital resources to be used for the contract and not on the basis of costs. Capital resources here refer to working and fixed capital. Capital allocation criteria for the purpose are derived and specified in [6] in accordance with accounting and economic theory. However, further work is required to operationalize the notions.

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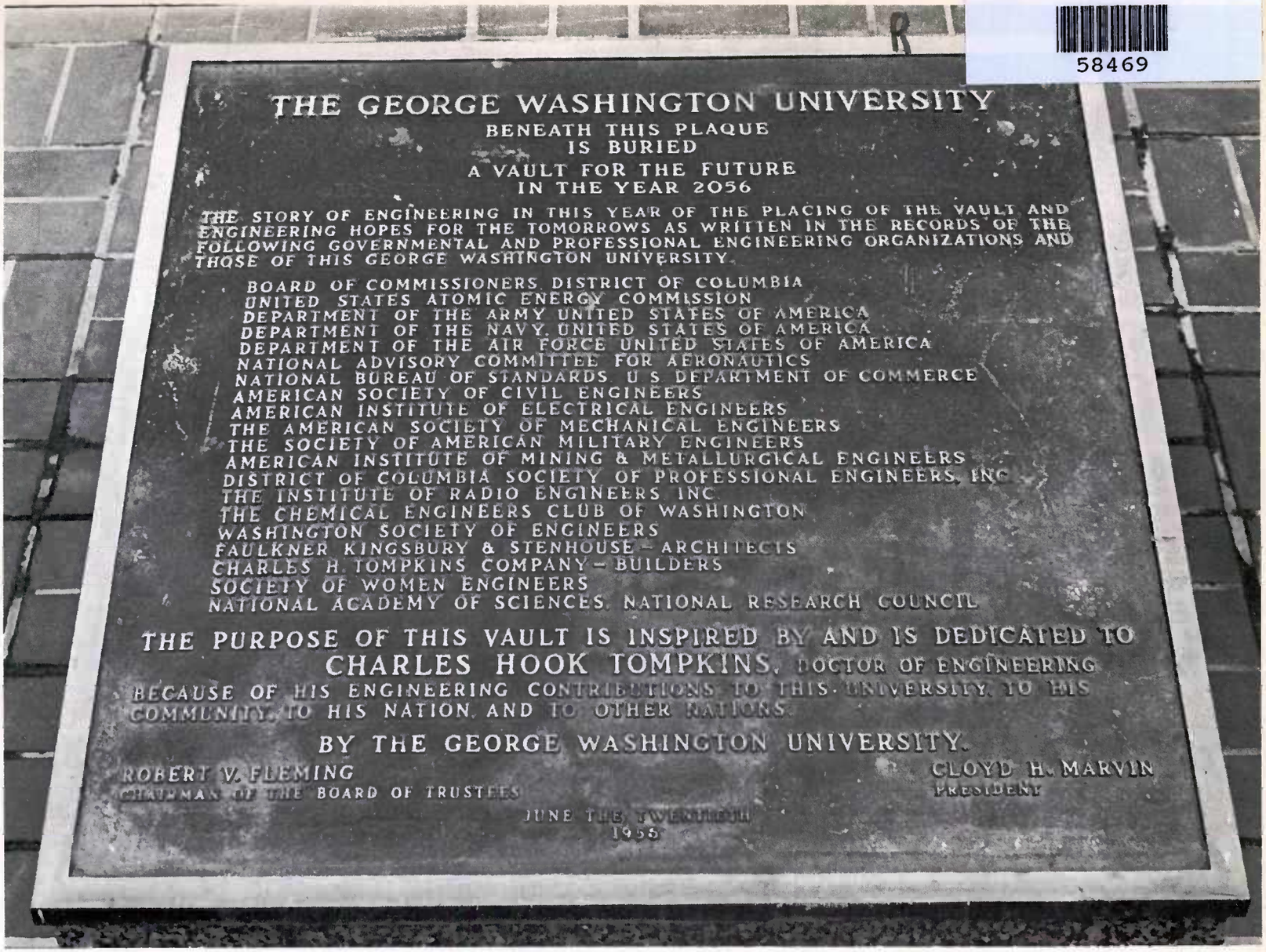

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